

The Sucker Project

Materials (per student):

- ▶ dental floss (approx. 4 inches in length)
- ▶ ruler with millimeter markings
- ▶ sucker with a circular cross-section
- ▶ clock that measures time in seconds

Procedure:

1. Use your dental floss and ruler to measure the initial circumference of the sucker in millimeters.
2. Determine the initial radius of the sucker (in millimeters) by using $C = 2\pi r$ and record it in the box corresponding to time = 0 in the table below.
3. Start sucking on the sucker and record 3 more radii and the corresponding elapsed times, measured in seconds. Wait approximately 120 seconds between measurements.

Time (x)	0	120	240	360
Radius (y)				

4. Enter the data from your table into your calculator and graph it.
 - a. What pattern do you see? linear
 - b. Why do you think this pattern happens? _____
5. Use the linear regression feature on the calculator to calculate the equation of the relationship of the data. Equation: _____
6. A line has a constant slope, so the slope of the tangent line at any point on the line will be the same as at any other point. Therefore, $\frac{dr}{dt} =$ _____. Use this $\frac{dr}{dt}$ and the data from your table to answer the questions that follow.
7. Lisa is sucking on a sucker that had an initial radius of 20 millimeters. If the rate of change of the radius of the sucker is -0.09 millimeters/second, what is the rate of change of volume:
 - a. when $r = 15$ mm?
 - b. when $r = 10$ mm?
 - c. What do you think happens to the rate of change of the volume as the radius gets smaller?

$\lim_{r \rightarrow 0} \left(\frac{dV}{dt} \right) = 0$, or as the sucker gets smaller, the rate at which the volume changes gets closer to zero.
 - d. Use what you've learned in AP Calculus to mathematically support your answer for 7c.

Source: Adapted from the activity "How Many Licks?" in *A Watched Cup Never Cools*, by Ellen Kamischke.